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THE WHITE HOUSE

WASHINGTON

March 10, 1995

Dear Colleague:

I am pleased to introduce the National Science and Technology Council (NSTC) 1995 Strategic Planning Documents. This document is one of nine Plans that reflect a concerted effort by each of the nine NSTC Committees, over the course of their first year, to articulate the goals, objectives, milestones, and metrics for the Federal R&D system. The Strategic Planning Documents provide a new and unique vehicle for discussing the appropriate focus of federal research efforts as well as planning for future endeavors. The public release of these documents reflects our continuing commitment to improve the Federal S&T enterprise.

It should be noted, however, that these Plans are not an end unto themselves, but rather a means to achieve national goals. Each Plan differs in approach and detail, just as each Committee has a different history, composition, and perspective; however, each Plan is central to the NSTC activities and all will be refined over time.

Since strategic planning is a continuing, evolving task, we know that we will periodically reassess and revise these documents. They must be viewed as snapshots of a dynamic, evolving process.

I hope that these materials, both individually and collectively, will form a useful foundation for a continuing dialogue within -- and beyond -- the Federal S&T enterprise.

Sincerely,


John H. Gibbons
Assistant to the President
for
Science and Technology

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UNITED STATES DEPARTMENT OF EDUCATION

January 24, 1995

THE DEPUTY SECRETARY

Honorable John H. Gibbons
Assistant to the President
for Science and Technology
The White House
Washington, DC 20500

Dear Dr. Gibbons:

It is my pleasure to transmit to you the Committee on Education and Training's Strategic Implementation Plan for Fiscal Years 1995 to 1999. This Plan carries out the Committee's charter for interagency coordination of research and development in education and training; promoting the use of technology to enhance lifelong learning; and promoting excellence in science, mathematics, and engineering education at all levels.

The Plan incorporates the efforts of our two subcommittees—Excellence in Science, Mathematics, and Engineering Education and Research and Development in Education and Training—as well as the Strategic Plan Working Group and the Budget Working Group. The National Education Goals as delineated in the Goals 2000: Educate America Act, the National Science Goals from Science in the National Interest, and the Administration's National Information Infrastructure Agenda for Action provide guiding principles for the Committee's efforts.

I believe that the Federal Government can help all Americans—at home, at school, and at the workplace—make the transition to the Information Age in four ways: by focusing attention on access to technology; by setting a common vision for the future; by providing information, research, and assistance; and by promoting partnerships that will link them with high-tech private sector agencies and organizations.

Special thanks are due to Luther Williams, Co-Vice Chair and Chair of the Excellence in Science, Mathematics, and Engineering Education Subcommittee; Sharon Robinson and Louis Finch, Co-Chairs of the Research and Development Subcommittee; Thomas Glynn, Co-Vice Chair; Frank Owens and K. Jane Coulter, Co-Chairs of the Strategic Plan Working Group; Stephen Leeds, Chair of the Budget Working Group; Laura Johns, Executive Secretary; and Linda Roberts, Special Adviser on Technology. We also appreciate and recognize the participation and support of all of the represented Federal agencies.

Sincerely yours,

Madeleine M. Kunin

400 MARYLAND AVE., S.W. WASHINGTON, D.C. 20203-0500

Our mission is to ensure equal access to education and to promote educational excellence throughout the Nation.

II

National Science and Technology Council

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III

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◀ Spacesuit demonstration with an elementary student by a NASA Aerospace Education Specialist (National Aeronautics and Space Administration).

IX



The most important measure of success for the National Science and Technology Council (NSTC) will be its ability to make improvements in the lives of Americans. Few enterprises touch the lives of as many people as do those concerned with education and training. High-quality education and training benefit the individual whose knowledge and skills are upgraded, the business seeking a competitive edge, and the Nation in achieving overall productivity and increasing competitiveness in the global marketplace. It is essential that all Americans have access to the education and training they need and that the teaching and learning enterprise itself becomes a high-performance activity.

In recognition of the importance of education and training—and of the necessity of bringing to bear the talent and coordinated resources of all the Federal agencies to create productive and successful education and training enterprises that support the lifelong learning needs of all Americans—the NSTC created the Committee on Education and Training (CET).

The CET was established to advise and assist the NSTC in coordinating and increasing the effectiveness and productivity of Federal efforts in education and training. Its purpose is to:

- Coordinate Federal research and development in education and training;
- Promote the use of technology to enhance lifelong learning; and
- Promote excellence in science, mathematics, and engineering education at all levels.

Committee on Education and Training (CET)

CET Vision

CET Plan

◀ *Students in Pacific Northwest Laboratory's (PNL) Option Program get help from a PNL scientist in their study of robotics (Department of Energy).*

To coordinate and focus Federal efforts in education and training so that they become a powerful force in helping Americans meet the challenges of the 21st century.

The CET has developed its Strategic/Implementation Plan to guide Federal efforts in education and training in accord with principles established by the National Education Goals as delineated in the "Goals 2000: Educate America Act," the National Science Goals as expressed in "Science in the National Interest," and the National Information Infrastructure Agenda for Action. The Plan provides a framework for making cross-agency policy, programmatic, and budgetary decisions, and for assessing the impact of these decisions. This framework centers on the vision and goals of the two subcommittees the CET has formed to meet its responsibilities. The two subcommittees are: The newly formed Subcommittee on Research and Development in Education and Training, and the Subcommittee on Excellence in Science, Mathematics and Engineering Education, continuing work started in 1990. Their visions, goals, objectives, and activities are outlined in this Plan.

R&D in Education and Training

Goals

The vision for research and development in education and training is:

Ensuring all Americans access to quality education and training tailored to their individual learning and workplace needs.

The goals for research and development are to:

- Provide National leadership in guiding education and training in its evolution toward the 21st century;
- Develop a research and development agenda for achieving the National Education Goals by the end of the decade;
- Promote increased resources for research and development in education and training; and
- Promote partnerships for demonstrating and deploying cost-effective learning technologies and techniques;
- Identifying and exploring areas of research and development that significantly improve learning;
- Coordinating the design and implementation of evaluations to assess the effectiveness of new education and training technologies and techniques;
- Identifying, demonstrating, and implementing exemplary models of cost-effective education and training;
- Making information on learning, research, and existing tools and techniques widely available; and
- Enhancing collaboration through interagency, intergovernmental, and industry partnerships that increase learning productivity for all Americans.

Objectives

Activities of research and development are organized around four focus areas:

- Demonstrating innovative technology and networking applications;
- Developing new models for evaluating learning and learning productivity;
- Developing high-quality, affordable learning tools and environments; and
- Promoting research on learning and cognitive processes.

**Excellence in Science,
Mathematics, and
Engineering Education**

Goals

The vision for excellence in science, mathematics, and engineering education is:

Achieving an American performance in science, mathematics, engineering, and technology in the classroom and the workplace that is second to none.

The goals for excellence in science, mathematics, and engineering education are:

- By the year 2000, all students will leave grades 4, 8, and 12 having demonstrated competency over challenging subject matters, including science and mathematics;
- By the year 2000, the Nation's teaching force will have access to programs for the continued improvement of their professional skills and the opportunity to acquire the knowledge and skills needed to instruct and prepare all American students for the next century;
- By the year 2000, United States students will be the first in the world in mathematics and science achievement;
- By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship; and
- Produce the finest scientists and engineers for the 21st century.

**Objectives and
Activities**

Objectives and activities for excellence in science, mathematics, and engineering education are organized around the following eight focus areas:

- Encouraging science as a core requirement for grades K-16;
- Promoting systemic reform of K-12 standards-based science, mathematics, technology, and engineering education;
- Promoting a competent and contemporary undergraduate science, mathematics, and engineering enterprise for a diverse student population;
- Promoting graduate and postdoctoral science and engineering education/training commensurate with human resource requirements;
- Promoting a competent, contemporary, and diverse scientific and technical work force;
- Focusing interagency programming on science and mathematics supported by technological education to ensure work force competency in a rapidly changing economy;

- Promoting Federal efforts to enhance public understanding of science and apply technology to lifelong learning; and
- Promoting efforts to determine the effectiveness of Federal investments in science, mathematics, engineering, and technology education and training programs.

Benefits

The Federal Government, as both a customer and partner of the Nation's work force, has a direct stake in the quality of education and training in America. In assuming its leadership role, the Federal Government is highlighting national challenges, mobilizing national support, and building partnerships involving Federal, State, and local governments, business and industry, professional associations and community-based organizations that will meet the challenges of the next century.

This Plan addresses the entire spectrum of education and training—from preschool activities through higher education, workplace training, and lifelong learning. Its infusion of new education and training capabilities that are now available from advances in learning technologies will ensure an acceleration toward fundamental reform. It will promote private sector interest in increasing the quality and lowering the cost of learning materials. It will provide nationally visible evidence of the value and practicality of learning technology and the essentiality of paradigm shifts needed to ensure learning productivity.

Over a decade ago, America was called "A Nation at Risk"** because American children were poorly educated compared to children in many other countries. This national report declared that America was failing its children and jeopardizing its future.

The report reflected and intensified rising concern at every level of Government, within the business and academic communities, and among parents and local leaders. In the 1980's, the Nation and the Federal Government began to respond to the challenge of changing the course of education. The culmination of that effort was the "Goals 2000: Educate America Act"**—legislation passed by Congress in 1994 that outlined daring steps to bring about fundamental and permanent change.

In 1993, the President's National Science and Technology Council (NSTC) was created to renew and reshape the science and technology components of the Federal enterprise. Goals, objectives, and priorities were developed collaboratively in an interagency forum with private sector input. The result was a set of policy principles and a set of Federal goals which represent a common framework to guide the Administration's science and technology investments.

Achieving these goals will require an ongoing supply of imaginative scientists and engineers, an educated and trained work force and wide public understanding. Thus, NSTC has a major stake in the effort to revitalize education and training in America as well as the assignment to mobilize the talent and resources of most, if not all, of the Federal agencies as part of this effort. To this end, it created the Committee on Education and Training (CET), with broader scope and responsibility than the previous committee which addressed education at the Federal level—the Committee on Education and Human Resources (CEHR)—and with a larger roster of member agencies and departments.

Committee on Education and Training (CET)

CET Charter

Comprised of many Federal member agencies and departments, the CET utilizes the interagency process to coordinate Federal education and training programs and education research and development efforts using the common set of Federal policy principles, goals, priorities, and evaluation criteria.

The CET advises and assists the NSTC to increase the overall effectiveness and productivity of Federal efforts in education and training through attention to research and development efforts and related policies that cut across agency boundaries. The CET provides a formal mechanism for interagency coordination of programs that:

* National Commission on Excellence in Education. *A Nation At Risk: The Imperative for Educational Reform*. Washington, D.C.: U.S. Department of Education, 1983.

** Public Law 103-227. (March 31, 1994)

- Support research and development in education and training;
- Promote the use of technology to enhance lifelong learning; and
- Promote excellence in science, mathematics, and engineering education at all levels.

The CET is chartered to:

- Promote collaboration and partnerships among CET agencies, State and local governments, and with private entities;
- Develop a balanced and comprehensive research and development program;
- Establish a structure to improve the way the Federal Government plans and coordinates education research and development; and
- Develop education budget crosscuts across agencies as well as priorities for education and training policy for all relevant Federal agencies.

Two subcommittees were formed to meet these responsibilities: 1) The Subcommittee on Research and Development in Education and Training, formed in 1994; and 2) the Subcommittee on Excellence in Science, Mathematics, and Engineering Education, with its roots going back to efforts started in 1990.

CET Vision

To coordinate and focus Federal efforts in education and training so that they become a powerful force in helping Americans meet the challenges of the 21st century by:

- Ensuring all Americans access to quality education and training tailored to their individual learning and workplace needs; and
- Achieving an American performance in science, mathematics, engineering, and technology in the classroom and the workplace that is second to none.

CET Strategy

The CET has developed this Strategic/Implementation Plan to guide the Federal effort in research and development in education and training, and in promoting excellence in science, mathematics, engineering, and technology education. By following this plan, Federal agencies can work as an integrated, coordinated team focused on a multiyear approach for managing and guiding efforts in accordance with the policy principles and goals previously set forth. The CET Plan provides a framework within which policy, programmatic, and budgetary decisions can be made and assessed.

The CET strategy is intended to address the entire education continuum—elementary and secondary education, undergraduate and graduate education, public understanding of science, work force training, and lifelong learning. It supports the “Goals 2000: Educate America Act” legislation, “Science in the National Interest,” and the NSTC emphasis on research and development in education technologies and learning productivity.

This Plan requires maintaining the integrity and strength of each program. They are interdependent, and each plays a critical role in meeting the relevant national education goals as well as working to ensure America's future economic and technological competitiveness by making today's education and training relevant to tomorrow's workplace.

Only the educated are free.
~ Epictetus



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Strategy

The Nation is experiencing a scientific and technological revolution of unprecedented proportions. Its benefits depend upon our capacity to meet the education and training challenges it presents. Fortunately, this revolution also provides the means to meet these challenges. New research in the areas of learning and teaching point to ways to improve curriculum and pedagogy.

The Vision

Ensuring all Americans access to quality education and training tailored to their individual learning and workplace needs.

This vision sees new environments for lifelong learning that use technology to support new models of learning and teaching for learners of all ages and conditions. These learning environments extend beyond the confines of classroom walls to include the home, the community (e.g., museums, libraries, community centers), and the workplace. They reach beyond the traditional school-age population. They will aggressively support learning of complex content and complex approaches to problem solving.

As a Nation, we are devoting limited resources to achieve this learning productivity vision. Funding for research and development in education and training comprises only 0.025% of education and training activity. While workplaces and workers are taking advantage of our latest technological advances, education and training lag farther and farther behind. We believe that a significant increase in our current level of Federal investment in education and training research and development is required.

Goals

- Provide National leadership in guiding education and training in its evolution toward the 21st century;
- Develop a research and development agenda for achieving the National Education Goals by the end of the decade;
- Promote increased resources for research and development in education and training; and
- Promote partnerships for demonstrating and deploying cost-effective learning technologies and techniques.
- Identify and explore areas of research and development that significantly improve learning beyond our current capabilities;
- Coordinate the design and implementation of evaluations to assess the effectiveness of new education and training technologies and techniques in a variety of settings;

Objectives

◀ *Student preparing to collect samples (Department of Energy).*

- Identify, demonstrate, and implement exemplary models of cost-effective education and training;
- Make information on learning research and existing tools and techniques widely available; and
- Enhance collaboration through interagency, intergovernmental, and industry partnerships that increase learning productivity for all Americans.

Focus Areas in Priority Order

Demonstrations of Innovative Technology and Networking Applications

Demonstrations of how hardware, software, and the National Information Infrastructure can be used for advanced instructional systems.

New Models for Evaluating Learning and Learning Productivity

Research and technology that lead to a richer set of assessment tools to measure learning productivity.

Development of High-Quality, Affordable Learning Tools and Environments

Development of tools that make use of technology to increase the productivity of learning in all fields, by all people. These tools may be used in a variety of settings, including schools, workplaces, and homes.

Research on Learning and Cognitive Processes

Research that can improve understanding of the learning process and how technology can best support the learning process.

International Dimension

Implementation of Ongoing Efforts

It is our intention to initiate, maintain, and increase contacts with the international community to coordinate distance learning and technology-based instructional activities leading to technical standards for increasing the availability and portability of education and training materials.

The Research and Development Subcommittee has coordinated a budget cross-cut across Federal agencies to determine the relative distribution of resources by Focus Area. The results of the budget assessment indicate that while the Federal Government has made substantial investments in learning research and tool development, programs to transition the products of research and development to the public and private sector have been underfunded. As a result, the CET has placed a high priority on facilitating national demonstrations and evaluations of learning technologies and the development of better evaluative tools and techniques. Research on learning and cognition and development of new learning tools and environments will be focused on the support of technology demonstrations and other technology transfer.

Implementation of New Efforts

Most of the work in the area of research and development in education and training falls within the scope of new efforts. The NSTC has dramatically expanded the scope and emphasis of this area, and as a result, the majority of work being done is in programmatic planning, definition and development.

Specific milestones and performance measures will depend upon the completion of the planning phases for each initiative. All planning is aimed at implementing operational phases by the end of the First Quarter of FY 1998.

The Research and Development Subcommittee will work closely with industry to improve communication and cooperation and to rapidly commercialize research and development products wherever possible. In general, the Federal agencies will focus on areas which are high risk or require complex experimental design and independent evaluation. The National Coordinating Council for Technology in Education and Training will serve as a key industry interface for the CET.

The Research and Development Subcommittee will also coordinate plans and initiatives with State and local communities. These projects will be designed with the input and participation of teachers, parents, workers, and business and community leaders in order to ensure that their needs and concerns are addressed.

The CET has created an interagency technology initiative to ensure that the goals and objectives of the Plan are fully coordinated across Federal agencies and to serve as a focal point for communication with State and local governments and industry. The initiative will:

- Draw upon the knowledge and expertise within each of the agencies as well as the public and private sectors;
- Coordinate plans, programs, and budgets for collaborative efforts; and
- Widely disseminate information on education and training related to research, development, and demonstrations.

Focus Areas

Sub-Elements

Demonstrations of Innovative Technology and Networking Applications

- **Education and training for disadvantaged youth and youth with disabilities**

Demonstrations of new approaches for young people with disabilities, academic or economic disadvantages, or limited English language proficiency to improve their access to education and training and the effectiveness of the education and training they receive.

- **Promotion of effective school-to-work transitions**

Demonstrations of new approaches that ease the transition of students from school to the workplace and that decrease the time it takes for them to fully participate as effective members of the work force.

- **Models and road maps for technology use to ensure that learners and instructors are capable of using educational technology**

Demonstrations of (a) new approaches that increase the efficiency and effectiveness with which technology is transferred to instructional institutions, (b) procedures that help prepare learners and instructors use instructional technology effectively, or (c) changes within institutions that help ensure effective use of instructional technology.

■ Professional development of teachers and instructors

Demonstrations of programs of instruction that increase the ability of teachers and instructors to prepare and provide effective instruction.

■ Manufacturing education and training

Demonstrations of new approaches that increase the efficiency and effectiveness with which students can be prepared to enter the manufacturing work force and the efficiency and effectiveness with which they can maintain their skills or acquire new skills to continue participating in the manufacturing sector.

■ Linkages among all levels of education, the private sector, and local communities

Demonstrations of new approaches that integrate all public and private instructional resources available within local communities, increase their accessibility to all members of the community, focus them on providing local solutions to local problems, and increase the viability of the communities.

■ Systemic education reform, institutional change, and overcoming barriers to the use of technologies for advanced modes of education and training

Demonstrations of new approaches that enhance the cost-effectiveness of instructional institutions, help integrate and encourage effective use of technology in their activities, and help them devise new organizational forms that enhance their productivity.

New Models for Evaluating Learning and Learning Productivity

■ Learning productivity

Research, development, and assessment of models and measures that establish relationships between the effective accomplishment of instructional objectives and useful descriptions and measures of the productivity of schools and other instructional programs and institutions. This category relates the effectiveness of instruction to definitions of the productivity of schools and training institutions.

■ Impact of learning productivity on institutional viability

Research, development, and assessment to determine how improvements in the effectiveness of education, such as school restructuring and the effectiveness of training, affect the viability, productivity, or well-being of the institutions (e.g., organizations, businesses, communities, countries) that provide them. This category includes school and organizational structuring and restructuring.

■ **New assessment tools**

Research, development, and assessment to design, implement, and use technology-based capabilities, such as those found in computer-based instruction, interactive videodisk instruction, and instructional simulation, to assess learning progress, simultaneous learner assessment and instruction, instruction based on simulation, learner self-assessment tools, learning tailored to individual needs, and standards-based learning.

Development of High-Quality, Affordable Learning Tools and Environments

■ **Materials development**

Research, development, and assessment to determine how best to design and implement tools for producing or "authoring" technology-based instructional materials, reusing and modifying existing technology-based materials when they conform with national standards, developing "just-in-time, just-enough" instruction, developing instruction embedded in operational equipment, developing interactive multimedia instruction, and constructing simulated environments for instruction. This element also includes development of technical standards for the production of all technology-based materials.

■ **Personalized teaching and learning capabilities**

Research, development, and assessment of technology-based capabilities that learners need to manage their instructional progress in school and lifelong learning settings. These capabilities range from technology-based learner's advisors through instructional management capabilities, to intelligent technology-based tutors.

■ **Collaborative problem solving**

Research, development, and assessment to design and implement learning environments that focus on collaborative efforts among students or workers and stimulate teamwork to solve problems posed in a learning environment. This category includes uses of technology to facilitate collaborative learning.

■ **Access to shared or distributed resources and expertise**

Research, development, and assessment to guide learners to sources of information they need and to make these sources of information accessible to all learners. These sources include digital libraries, human subject matter experts, and mentors.

■ **Integration of technology-based instruction**

Research, development, and assessment to help ensure that teachers and instructors can successfully incorporate technology into their existing instruction, that technology-based learning tools meet both local and national standards, and that today's instructional institutions and workplaces realize the benefits of new instructional technology as quickly as possible.

Research on Learning and Cognitive Processes

■ New learning paradigms

Research and development to improve our understanding of how people learn and of the mechanisms and processes through which instruction can and does affect learning. This category includes basic research on cognition, learning, and memory and on how they are affected by instruction.

■ Effecting change in teaching and training

Research and development on ways to effect change in our current institutions for teaching, training, and lifelong learning. This category includes efforts to determine (a) the roles that teachers, students, and lifelong learners should play to increase the effectiveness of learning and (b) ways to incorporate these roles in instructional institutions and workplaces.

■ Curriculum structuring and restructuring

Research and development on the design of a standards-based curriculum and programs of instruction. This category of research and development includes efforts to design and structure a curriculum so that it takes advantage of technology-based capabilities for administrative management, information handling, and the tailoring of instruction to each individual's needs, interests, abilities, and learning style.

■ Special needs

Research and development to identify the unique instructional challenges faced by learners in special populations, to assess their ability to respond to these challenges, and to exploit the capabilities offered by technology-based instruction. These populations include learners who must overcome disabilities, academic or economic disadvantages, limited English language proficiency, or other difficulties to take advantage of instructional opportunities and participate fully in the work force.

■ Cognitive task analysis

Research and development to determine the cognitive processes that underlie the skill and knowledge requirements needed to accomplish real-world tasks. This activity includes research to better understand the evolving content needs of growth-oriented knowledge industries and the cognitive tasks that individuals must possess to meet these needs.

Education costs money, but then, so does ignorance.

~ Sir Claus Moser

Science in Technology Engineering

Strategy

Mathematics, science, engineering, and technology education are central to the education process and have a profound effect on our Nation's economic competitiveness and on the quality of life of its citizens. A citizenry well educated in the sciences, mathematics, and technology is thus essential to the civic and economic health and well-being of the Nation.

The Vision

The Vision that draws the Federal agencies together working in partnership with State and local educators and industry to promote excellence in science, mathematics, engineering, and technology is thus one which aims at:

Achieving an American performance in science, mathematics, engineering, and technology in the classroom and the workplace that is second to none.

Goals

The Goals that sustain this Vision are woven together with many of those found in "Goals 2000: Educate America Act," and the recent report, "Science in the National Interest." Through the combined and collaborative efforts of the Federal agencies working under the CET, much progress can be made in making these visions come true.

- By the year 2000, all students will leave grades 4, 8, and 12 having demonstrated competency over challenging subject matters, including science and mathematics.
- By the year 2000, the Nation's teaching force will have access to programs for the continued improvement of their professional skills and the opportunity to acquire the knowledge and skills needed to instruct and prepare all American students for the next century.
- By the year 2000, U. S. students will be first in the world in mathematics and science achievement.
- By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.
- Produce the finest scientists and engineers for the 21st century.

Objectives

These Goals will be pursued through a set of more specific objectives:

- Encourage science as a core requirement for grades K-12.
- Promote systemic reform of K-12 standards-based science, mathematics, technology, and engineering education.

- Promote a competent and contemporary undergraduate science, mathematics, and engineering enterprise for a diverse student population.
- Promote graduate and postdoctoral science and engineering education/training commensurate with human resource requirements.
- Promote a competent, contemporary, and diverse scientific and technical work force.
- Focus interagency programming on science and mathematics supported by technological education to ensure work force competency in a rapidly changing economy.
- Promote Federal efforts to enhance public understanding of science and apply technology to lifelong learning.
- Promote efforts to determine the effectiveness of Federal investments in science, mathematics, engineering, and technology education and training programs.

Implementation of Ongoing Efforts

Member agencies of the Excellence in Science, Mathematics, and Engineering Education Subcommittee initiated and continued many programs starting with the FY 1992 budgetary process.

Systemic Reform and Standards-Based Education

■ Systemic Reform in Urban and Rural Areas

During 1993-1994 the National Science Foundation gave grants to 24 States and Puerto Rico through its Statewide Systemic Initiatives, made awards to nine urban areas under its Urban Systemic Initiatives to initiate planning for systemic reform, and awarded two development grants and four planning grants in rural areas. These initiatives support comprehensive educational reform by bringing together State and local education leaders, businesses, parents, and other community leaders for the planning and implementation processes.

■ Standards-Based Education

Collaborations have been formed among CET agencies, including the National Science Foundation, the Department of Education, the National Aeronautics and Space Administration, and the Department of Health and Human Services, to provide funding to support the development of standards-based curriculum frameworks which would challenge the students. By the end of 1995, the National Academy of Sciences is to complete and distribute standards for teaching science, science curriculum development, and assessment.

Teacher Enhancement Activities and Reform of Teacher Certification Requirements

The CET agencies have also concentrated on teacher enhancement activities. CET agencies provided more than 160,000 teachers in FY 1993 and FY 1994 with intensive, multiple-week professional development designed to expose them to new content as well as improve their pedagogical skills. The programs are designed to provide participants with a unique opportunity to explore new dimensions of learning and teaching mathematics and science. Further, these efforts are tied to challenging standards and will help ensure that teachers are prepared to teach their students to the standards.

Dissemination

In FY 1992, CET Federal agencies participated in a comprehensive inventory of Federally sponsored education and training programs. Results of the inventory have been published in "A Guidebook to Excellence," which is available on-line and in hard copy. This publication is updated annually and describes individual programs and partnership opportunities grouped by agency and by region, and includes points of contact for education efforts which are Federally sponsored.

The CET member agencies also sponsor a publication entitled "A Resource Guide to Selected Undergraduate Programs of 10 Federal Agencies."

Assessment

CET member agencies are funding the identification or development of models and tools for the assessment of the effectiveness of teaching techniques, tools, and the efficiency of student learning. Some programs are focused on the development of models for the assessment of student progress relative to the mathematics and science standards. Completion of these assessment tools is expected in 1996.

Programs have been initiated to develop realistic and widely applicable measures to identify successful programs and exemplary products for use by agencies in directing their own efforts.

Public Understanding of Science

Several programs have been created to provide better access to and dissemination of the vast knowledge base that exists within the laboratories and facilities of member agencies. Technology has enabled agencies to make scientists readily available to assist with classroom experiments, experts to answer questions, and better access to supercomputers and satellite information. Interactive distributed education environments are being demonstrated around the world and government and private companies have been enlisted to assist in developing this new classroom environment. These experiments in information dissemination and distributed education are part of planning for facilitating the process of lifelong learning.



New and Enhanced Efforts

Focus Areas

In addition to the continuation of ongoing programs, many are being enhanced, and a number of new programs are being introduced.

Science as a Core Requirement for Grades K-16

Milestone for Development of Science as a Core Requirement

- Starting in FY 1996, CET will have in place a coordinated strategy for the development of science as a core requirement for grades K-16.

Systemic Reform of K-12 Standards-Based Science, Mathematics, and Engineering Education

Milestones for Elementary and Secondary Organizational and Systemic Reform

- In FY 1995, CET agencies will make additional grant awards under Goals 2000 to assist States and local areas in planning systemic educational change.
- In FY 1995, CET agencies will make available to all States information learned from the statewide systemic initiatives.
- In FY 1995 and FY 1996, systemic educational reform efforts will be expanded in up to twenty-five urban and six major rural areas where large numbers of ethnic/racial and economically disadvantaged populations are located.
- In FY 1996, CET will continue to conduct distance learning and distributed education.

Milestones for Elementary and Secondary Teacher Preparation and Enhancement

- Starting in FY 1995, all science and mathematics funds under the National Eisenhower Program will support consortia of institutions of higher education, State education agencies, and local school districts in order to align preservice teacher preparation and licensure provisions with new world-class mathematics and science standards. In addition, funds from the State Eisenhower Program will support intensive, high-quality teacher professional development.
- In FY 1995, the Subcommittee will develop a Federal plan to create research scientist-teacher partnerships and, in FY 1996, will pilot a program involving 2 to 5 States for teacher-researcher partnerships, including government, academia, and industry with appropriate incentives.
- In 1995, at least 20 major K-8 system-wide teacher enhancement projects will be funded and instructional materials databases will be on-line, providing information on supported curriculum and materials for teachers, administrators, and parents, etc.

◀ Students work with an instructor to perform a Beams Magnet Racing experiment in a physics exercise (Department of Energy).

- In FY 1995, the Evaluation Working Group will conduct an evaluation of the quality of teacher enhancement activities in Federal laboratories. The evaluation will become part of the overall assessment of Federal laboratories' capabilities to conduct teacher enhancement activities.
- By 1996, CET agencies will have 15 teacher education collaboratives in place, impacting 213,000 undergraduate students and engaging 8,000 faculty, and 7,000 master teachers.
- By FY 1999, 600,000 teachers—with special emphasis on teachers from and of underrepresented groups and those at the elementary level—will receive intensive disciplinary and pedagogical professional development through Federal agency teacher enhancement programs.
- By FY 2000, 25 consortia are projected to be in place, providing an estimated one-half of new elementary and secondary mathematics and science teachers with new, more effective, intellectually and pedagogically appropriate modes of pre-service teacher instruction, and one-third of all science and mathematics teachers will graduate from schools participating in consortia-sponsored programs.

Milestones for Elementary and Secondary Standards and Assessments

- In FY 1995, a plan will be implemented on the Federal role in facilitating the adoption of the science standards through the research and education communities.
- Beginning in FY 1995, CET agencies will continue to provide support and incentives for implementation at the State and local level of challenging standards in mathematics and science education, such as those developed by National Council of Teachers of Mathematics and the National Academy of Sciences.
- In FY 1995-1999, through the National Assessment of Educational Progress, the Department of Education will continue conducting national and State-by-State assessments, on a regular basis, that measure progress toward the National Education Goals.
- By FY 1998, agencies will provide support to enable completion of model assessments for use by States, districts, teachers, and others to measure the performance of individual students against world-class mathematics and science standards.
- By FY 1999, CET agencies will support the development of measures, definition of samples, and administration of two sets of international assessments of student performance in mathematics and science.

Milestones for Elementary and Secondary Instructional Resources

- Beginning in FY 1995, CET agencies will ensure that all materials developed with Federal support conform to challenging State or National standards such as the evolving National Academy of Sciences science standards and the National Council of Teachers of Mathematics standards for mathematics.
- By FY 1996, the National Science Foundation will ensure the development of a comprehensive set of mathematics curriculum models for elementary through secondary levels and, by FY 1997, will have supported the development of a comprehensive set of science curriculum models which will be available for the elementary through secondary levels.
- CET agencies will continue to contribute to a process for review and revision of science and mathematics standards and frameworks.

Competent and Contemporary Undergraduate Science, Mathematics, and Engineering Enterprise for a Diverse Student Population

Milestones for Undergraduate Instructional Resources

- In FY 1995, CET agencies will continue an inventory of their currently available technical education and training programs to develop goals, priorities, and strategies specifically for technical education and training.
- In FY 1995, CET agencies will begin to provide support in associate degree granting institutions for at least five centers of excellence in instructional programs in advanced technology fields.
- By FY 1996, the materials and instructional approaches developed through programs supported by CET agencies to revitalize science, mathematics, engineering, and technology education at colleges and universities will benefit at least one-third of the students enrolled in lower-division studies.
- By FY 1999, the materials and instructional approaches developed through programs supported by CET agencies to revitalize science, mathematics, engineering, and technology education at colleges and universities will benefit at least two-thirds of the students enrolled in lower-division studies.

Milestones for Undergraduate Faculty Preparation and Enhancement

- By FY 1996, CET agencies, in partnership with industrial organizations, will provide faculty enhancement activities for at least 16,000 undergraduate faculty involved in teaching science, mathematics, engineering, and technology.



- In FY 1995, CET agencies will sponsor seminars in different regions of the United States to help science, mathematics, engineering, and technology faculty and administrators in associate degree-granting institutions become involved with Federal programs and be aware of awards that have been made to 2- to 4-year institutions in collaboration with secondary schools and 4-year institutions.
- By FY 2000, CET agencies and industrial partners will provide faculty enhancement for at least 50,000 science, mathematics, engineering, and technology faculty members at both 2- and 4-year institutions.

Milestones for Undergraduate Student Incentives

- By FY 1997, CET agencies will have in place mechanisms to encourage research experience incentives for undergraduate students in Federal research grant awards.

Graduate and Postdoctoral Science and Engineering Education/Training Commensurate with Human Resource Requirements

Milestones for Graduate Education and Instructional Resources

- In FY 1995, CET agencies will continue, through graduate research awards to institutions, to target student support both into selected discipline areas of critical national need and into experimental approaches to predoctoral education.
- Beginning in FY 1995, CET agencies will design and implement special initiatives to promote sorely needed articulation between undergraduate and graduate education programs.
- Starting in FY 1995, CET agencies will encourage universities to broaden the structure and focus of their graduate degree programs to ensure the competitiveness of their Ph.D. students in the market place and the competency of the U.S. scientific work force overall.

Milestones for Graduate Faculty Preparation and Enhancement

- Starting in FY 1995, CET agencies will provide teaching preparation for graduate students in science, mathematics, engineering, and technology fields.

Milestones for Graduate Student Incentives

- In FY 1995, CET agencies will inventory agency-sponsored programs targeted to underrepresented groups in graduate education.
- Beginning in FY 1995, Federal agencies should expand financial and other types of incentives to attract outstanding U.S. citizens and permanent residents to graduate programs in the fields of science, mathematics, engineering, or technology in which greater participation is required to meet national needs.

◀ *Patient working with an educational therapist (Department of Veterans Affairs).*

- By FY 1997, CET agencies will improve the quality, timeliness, comprehensiveness, and availability of national data on graduate education programs that they maintain.

Competent, Contemporary, and Diverse Scientific and Technical Work Force

Milestones to Increase Diversity

- In FY 1995, the first Presidential Awards for individuals and institutions with outstanding records in mentoring students from underrepresented groups will be initiated.
- In FY 1995, the Federal member agencies will develop a plan for incorporating an evaluation criterion related to increasing participation by underrepresented groups.
- Starting in FY 1996, CET will have in place and implement a coordinated strategy designed to foster increased participation of underrepresented groups.

Science and Mathematics Supported by Technological Education to Ensure Workforce Competency in a Rapidly Changing Environment

Milestones for Technological Education

- BY 1995, CET agencies will further efforts to increase technological education capabilities by supporting three centers of excellence in instructional programs in advanced-technology fields at associate degree-granting institutions and supporting the development of high technology learning centers.
- By FY 1996, Federal laboratories will conduct specialized technical apprenticeship programs reaching a minimum of 3,000 participants, including high school and community college graduates and displaced workers.

Federal Efforts to Enhance Public Understanding of Science and Apply Technology to Lifelong Learning

Milestones for Public Understanding of Science and Technology

- In FY 1995, CET will develop and adopt a "vision" for all Federally funded public understanding of science programs, and in FY 1996, will consider recommendations developed for a multidimensional national assessment of public understanding of science and determine whether such an assessment is feasible as well as produce and disseminate a resource guide of Federal public understanding of science resources and activities.
- In FY 1995, CET will convene conferences to address issues, such as alternative sets of standards for public understanding of science and public science literacy, identify data needs, and propose effective education strategies with a special emphasis on reaching underserved populations.

- By FY 1999, CET agencies will expand their support for public understanding of science programs targeted at decision-makers to significantly increase their understanding of science and public understanding of science-related issues.
- In FY 1995, CET will complete a descriptive inventory of agency public understanding of science programs.

Determining the Effectiveness of Federal Investments in Science, Mathematics, and Engineering Education and Training Programs

Milestones for Evaluation and Dissemination

- In FY 1995, the Dissemination and Evaluation Working Group will conduct an evaluation of the quality of teacher enhancement activities in Federal laboratories. The evaluation will become a part of the overall assessment of Federal laboratories' capabilities to conduct teacher enhancement activities.
- In FY 1995, CET will develop and disseminate an inventory of model articulation programs that bridge the transition between secondary schools and 2- and 4-year institutions, between 2-year and 4-year institutions, and between undergraduate and graduate schools.
- In FY 1995, a program of research and study will determine the link between Federal resource allocation for mathematics and science education, including amounts dedicated to teacher preparation and enhancement, and long-term changes in student achievement in pertinent disciplines.
- By FY 1998, each agency will complete its first cycle of program evaluations and will disseminate the results.

***Human history becomes more and more a race
between education and catastrophe.***

~ H.G. Wells

GOALS 2000: EDUCATE AMERICA ACT* NATIONAL EDUCATION GOALS

- 1. School Readiness**
- 2. School Completion**
- 3. Student Achievement and Citizenship**
- 4. Teacher Education and Professional Development**
- 5. Mathematics and Science**
- 6. Adult Literacy and Lifelong Learning**
- 7. Safe, Disciplined, and Alcohol-and Drug-free Schools**
- 8. Parental Participation**

* Public Law 103-227. (March 31, 1994)

NATIONAL SCIENCE GOALS

- 1. Maintain Leadership Across the Frontiers of Scientific Knowledge**
- 2. Enhance Connections Between Fundamental Research and National Goals**
- 3. Stimulate Partnerships that Promote Investments in Fundamental Science and Engineering and Effective Use of Physical, Human, and Financial Resources**
- 4. Produce the Finest Scientists and Engineers for the 21st Century**
- 5. Raise the Scientific and Technological Literacy of All Americans**

* Executive Office of the President. Office of Science and Technology Policy. *Science in the National Interest*. Washington, D.C., August 1994.



Committee on Education and Training

To coordinate and focus Federal efforts in education and training so that they become a powerful force in the task of helping Americans meet the challenges of the 21st century.

Research and Development In Education and Training

Vision

Ensuring all Americans access to quality education and training tailored to their individual learning and workplace needs

Goals

- Provide National leadership in guiding education and training in its evolution toward the 21st century.
- Develop a research and development agenda for achieving the National Education Goals by the end of the decade.
- Promote increased resources for research and development in education and training.
- Promote partnerships for demonstrating and deploying cost-effective learning technologies and techniques.

Focus Areas:

- Demonstrating innovative technology and networking applications.
- Develop new models for evaluating learning and learning productivity.
- Developing quality, affordable learning tools and environments.
- Promoting research on learning and cognitive processes.

Excellence in Science, Mathematics, and Engineering Education

Vision

Achieving an American performance in science, mathematics, engineering, and technology in the classroom and the workplace that is second to none.

Goals

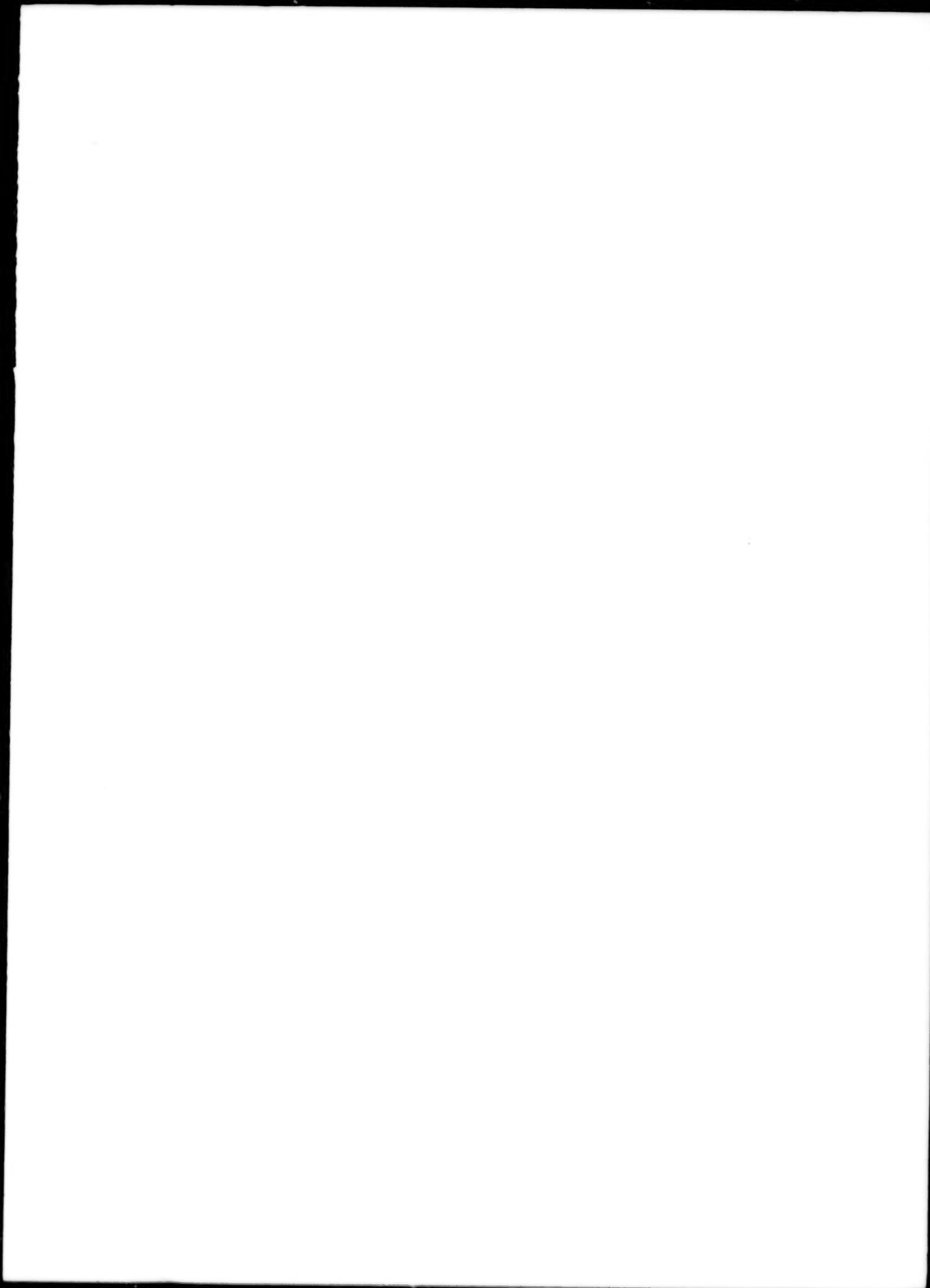
- By the year 2000, all students will leave grades 4, 8, and 12 having demonstrated competency over challenging subject matters including science and mathematics.
- By the year 2000, the Nation's teaching force will have access to programs for the continued improvement of their professional skills and the opportunity to acquire all knowledge and skills needed to instruct and prepare all American students for the next century.
- By the year 2000, United States students will be first in the world in mathematics and science achievement.
- By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.
- Produce the finest scientists and engineers for the 21st century.

Focus Areas:

- Encouraging science as a core requirement for grades K-16.
- Promoting systemic reform of K-12 standards-based science, mathematics, technology and engineering education.
- Promoting a competent and contemporary undergraduate science, mathematics, and engineering enterprise for a diverse student population.
- Promoting graduate and post doctoral science and engineering education/training commensurate with human resource requirements.
- Promoting a competent, contemporary, and diverse scientific and technical work force.
- Focusing interagency programming on science and mathematics supported by technological education to ensure work force competence in a rapidly changing economy.
- Promoting Federal efforts to enhance public understanding of science and apply technology to lifelong learning.
- Promoting efforts to determine the effectiveness of Federal investments in science, mathematics, engineering, and technology education and training programs.



◀ *NSF-sponsored project by the South Dakota Statewide Systemic Initiative shows youngsters engaged in a hands-on learning activity involving geology (National Science Foundation).*



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